

**What is claimed is:**

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1. An apparatus comparing an obtained first fingerprint with a preliminarily registered second  
5 fingerprint, and determining whether or not the fingerprints match each other, comprising:  
a ridge relation obtaining unit obtaining  
relation of a ridge containing a vicinal feature  
point near a feature point to be checked in a matching  
10 process performed on the first and the second  
fingerprints to the ridge containing the feature  
point to be checked in the matching process; and  
a matching unit performing the matching  
process by searching the second fingerprint  
15 containing the vicinal feature point near the feature  
point to be checked in the matching process for the  
relation of the ridge containing the vicinal feature  
point to the ridge containing the feature point in  
the first feature point to be checked in the matching  
20 process.
2. The apparatus according to claim 1, wherein  
said information about the feature point has  
a format comprising an identifier assigned to each  
25 feature point and corresponding feature information

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about the feature point.

3. The apparatus according to claim 1, wherein  
when a number of ridges from the feature point  
5 to be checked to a ridge containing the vicinal  
feature point, and when feature information about  
the vicinal feature points matches in a predetermined  
range, it is determined that feature points to be  
checked contained in the first and the second  
10 fingerprints are same feature points.

4. The apparatus according to claim 1, wherein  
in said first and second fingerprint, when said  
feature information about the vicinal feature points  
15 matches in a predetermined range, a number of ridges  
between the feature point to be checked and a ridge  
containing the vicinal feature point matches a value  
obtained by counting a number of ridges in an opposite  
direction from the feature point to be checked to  
20 the vicinal feature point, and a number of ridges  
between the feature point to be checked and a ridge  
containing the vicinal feature point matches a value  
obtained by counting a number of ridges in a direction  
from the feature point to be checked to the vicinal  
25 feature point, it is determined that feature points

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to be checked contained in the first and the second fingerprints are same feature points.

5. The apparatus according to claim 1, wherein  
5 when said first and second fingerprints match in at least one of position, type, and direction of the vicinal feature points, it is determined that feature information of feature points to be checked contained in the first and the second fingerprints  
10 are same feature points.

6. The apparatus according to claim 1, wherein  
when said feature points to be checked match in position and direction in a predetermined range,  
15 but are different in type in said first and second fingerprints, a resultant matching level is low.

7. The apparatus according to claim 1, wherein  
when said vicinal feature points match in  
20 position and direction in a predetermined range, but are different in type in said first and second fingerprints, a resultant matching level is low.

8. The apparatus according to claim 1, wherein  
25 when said feature points to be checked are

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different in type in said first and second fingerprints, a matching process is performed by changing relation between ridges containing the feature points to be checked and ridges containing the vicinal feature points.

9. An apparatus comparing an obtained first fingerprint with a preliminarily registered second fingerprint, and determining whether or not the fingerprints match each other, comprising:

a virtual feature point generation unit generating a virtual feature point by referring to the first and the second feature points;

a ridge relation obtaining unit obtaining relation of a ridge containing the virtual vicinal feature point near the feature point to be checked in a matching process performed on the first and the second fingerprints to the ridge containing the feature point to be checked in the matching process;

and

a matching unit performing the matching process by searching the second fingerprint containing the virtual vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing

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the virtual vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching process.

- 5 10. The apparatus according to claim 9, wherein  
said information about the virtual feature  
point has a format comprising an identifier assigned  
to each virtual feature point and corresponding  
feature information about the virtual feature point.
- 10 11. The apparatus according to claim 9, wherein  
when a number of ridges from the feature point  
to be checked to a ridge containing the virtual  
vicinal feature point, and when feature information  
15 about the virtual vicinal feature points matches  
in a predetermined range, it is determined that  
feature points to be checked contained in the first  
and the second fingerprints are same feature points.
- 20 12. The apparatus according to claim 9, wherein  
when said first and second fingerprints match  
in at least one of position, type, and direction  
of the virtual vicinal feature points, it is  
determined that feature information of feature  
25 points to be checked contained in the first and the

00665159.091900

second fingerprints are same feature points.

13. The apparatus according to claim 9, wherein  
when said feature points to be checked match  
5 in position and direction in a predetermined range,  
but are different in type in said first and second  
fingerprints, a resultant matching level is low.
14. The apparatus according to claim 9, wherein  
10 when said virtual vicinal feature points match  
in position and direction in a predetermined range,  
but are different in type in said first and second  
fingerprints, a resultant matching level is low.
- 15 15. The apparatus according to claim 9, wherein  
said virtual feature point is generated by  
projecting an existing feature point to a vicinal  
ridge.
- 20 16. The apparatus according to claim 15, wherein  
feature information about the virtual feature  
point is feature information about a feature point  
from which a virtual feature point is projected.
- 25 17. The apparatus according to claim 9, wherein

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when said feature points to be checked are different in type in said first and second fingerprints, a matching process is performed by changing relation between ridges containing the feature points to be checked and ridges containing the vicinal feature points.

18. An apparatus comparing an obtained first fingerprint with a preliminarily registered second fingerprint, and determining whether or not the fingerprints match each other, comprising:

a virtual feature point generation unit generating a virtual feature point by referring to the first and the second feature points;

a ridge relation obtaining unit obtaining relations of a ridge containing a vicinal feature point near a feature point, and a ridge containing the virtual vicinal point to be checked in a matching process performed on the first and the second fingerprints to the ridge containing the feature point to be checked in the matching process; and

a matching unit performing the matching process by searching the second fingerprint containing the vicinal feature point near the feature point to be checked in the matching process for the

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relation of the ridge containing the vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching process, and performing the matching process by searching the second fingerprint containing the virtual vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the virtual vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching process, thereby determining whether or not the feature point to be checked is matching.

19. The apparatus according to claim 18, wherein when said feature point to be checked matches in position and direction in said first and second fingerprints in a predetermined range, but does not match in type, evaluation of a matching result is set low.

20. The apparatus according to claim 18, wherein when said vicinal feature point or said virtual feature point matches in position and direction in a predetermined range in the first and second fingerprints, but does not match in type, evaluation

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of a matching result is set low.

21. The apparatus according to claim 20, wherein  
a matching process is performed on a  
5 combination of the vicinal feature point of said  
first and second fingerprint and the virtual feature  
point.

22. The apparatus according to claim 18, wherein  
10 when said first and second fingerprints match  
in feature points to be checked and said vicinal  
feature points match several times for the feature  
points to be checked, evaluation of a matching result  
is enhanced depending on a number of matching  
15 results.

23. A method for comparing an obtained first  
fingerprint with a preliminarily registered second  
fingerprint, and determining whether or not the  
20 fingerprints match each other, comprising:

(a) obtaining relation of a ridge containing  
a vicinal feature point near a feature point to be  
checked in a matching process performed on the first  
and the second fingerprints to the ridge containing  
25 a feature point to be checked in the matching process;

00665159-091900

and

(b) performing the matching process by searching the second fingerprint containing the vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching process.

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24. The method according to claim 23, wherein said information about the feature point has a format comprising an identifier assigned to each feature point and corresponding feature information about the feature point.

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25. The method according to claim 23, wherein when a number of ridges from the feature point to be checked to a ridge containing the vicinal feature point, and when feature information about the vicinal feature points matches in a predetermined range, it is determined that feature points to be checked contained in the first and the second fingerprints are same feature points.

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26. The method according to claim 23, wherein  
in said first and second fingerprint, when said  
feature information about the vicinal feature points  
matches in a predetermined range, a number of ridges  
5 between the feature point to be checked and a ridge  
containing the vicinal feature point matches a value  
obtained by counting a number of ridges in an opposite  
direction from the feature point to be checked to  
the vicinal feature point, and a number of ridges  
10 between the feature point to be checked and a ridge  
containing the vicinal feature point matches a value  
obtained by counting a number of ridges in a direction  
from the feature point to be checked to the vicinal  
feature point, it is determined that feature points  
15 to be checked contained in the first and the second  
fingerprints are same feature points.

27. The method according to claim 23, wherein  
when said first and second fingerprints match  
20 in at least one of position, type, and direction  
of the vicinal feature points, it is determined that  
feature information of feature points to be checked  
contained in the first and the second fingerprints  
are same feature points.

28. The method according to claim 23, wherein  
when said feature points to be checked match  
in position and direction in a predetermined range,  
but are different in type in said first and second  
5 fingerprints, a resultant matching level is low.

29. The apparatus according to claim 23, wherein  
when said vicinal feature points match in  
position and direction in a predetermined range,  
10 but are different in type in said first and second  
fingerprints, a resultant matching level is low.

30. The apparatus according to claim 23, wherein  
when said feature points to be checked are  
15 different in type in said first and second  
fingerprints, a matching process is performed by  
changing relation between ridges containing the  
feature points to be checked and ridges containing  
the vicinal feature points.

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31. A method for comparing an obtained first  
fingerprint with a preliminarily registered second  
fingerprint, and determining whether or not the  
fingerprints match each other, comprising:

25 (a) generating a virtual feature point by

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referring to the first and the second feature points;

(b) obtaining the relation of the ridge containing a virtual vicinal feature point near the feature point to be checked in a matching process performed on the first and the second fingerprints to the ridge containing the feature point to be checked in the matching process; and

(c) performing the matching process by searching the second fingerprint containing the virtual vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the virtual vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching process.

32. The method according to claim 31, wherein said information about the virtual feature point has a format comprising an identifier assigned to each virtual feature point and corresponding feature information about the virtual feature point.

33. The method according to claim 31, wherein when a number of ridges from the feature point to be checked to a ridge containing the virtual

00665159.091900

vicinal feature point, and when feature information about the virtual vicinal feature points matches in a predetermined range, it is determined that feature points to be checked contained in the first and the second fingerprints are same feature points.

34. The method according to claim 31, wherein when said first and second fingerprints match in at least one of position, type, and direction of the virtual vicinal feature points, it is determined that feature information of feature points to be checked contained in the first and the second fingerprints are same feature points.

35. The method according to claim 31, wherein when said feature points to be checked match in position and direction in a predetermined range, but are different in type in said first and second fingerprints, a resultant matching level is low.

36. The method according to claim 31, wherein when said virtual vicinal feature points match in position and direction in a predetermined range, but are different in type in said first and second fingerprints, a resultant matching level is low.

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37. The method according to claim 31, wherein  
said virtual feature point is generated by  
projecting an existing feature point to a vicinal  
ridge.  
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38. The method according to claim 37, wherein  
feature information about the virtual feature  
point is feature information about a feature point  
from which a virtual feature point is projected.  
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39. The method according to claim 17, wherein  
when said feature points to be checked are  
different in type in said first and second  
fingerprints, a matching process is performed by  
changing relation between ridges containing the  
feature points to be checked and ridges containing  
the vicinal feature points.  
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40. A method for comparing an obtained first  
fingerprint with a preliminarily registered second  
fingerprint, and determining whether or not the  
fingerprints match each other, comprising:  
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(a) generating a virtual feature point by  
referring to the first and the second feature points;  
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00665159-091900

(b) obtaining relations of a ridge containing a vicinal feature point near the feature point, and a ridge containing a virtual vicinal point to be checked in a matching process performed on the first  
5 and the second fingerprints to the ridge containing the feature point to be checked in the matching process; and

(c) performing the matching process by searching the second fingerprint containing the  
10 vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching  
15 process, and performing the matching process by searching the second fingerprint containing the virtual vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the virtual vicinal feature  
20 point to the ridge containing the feature point in the first feature point to be checked in the matching process, thereby determining whether or not the feature point to be checked is matching.

25 41. The method according to claim 40, wherein

00665159.091900



when said feature point to be checked matches in position and direction in said first and second fingerprints in a predetermined range, but does not match in type, evaluation of a matching result is set low.

42. The method according to claim 40, wherein when said vicinal feature point or said virtual feature point matches in position and direction in a predetermined range in the first and second fingerprints, but does not match in type, evaluation of a matching result is set low.

43. The method according to claim 42, wherein a matching process is performed on a combination of the vicinal feature point of said first and second fingerprint and the virtual feature point.

44. The method according to claim 40, wherein when said first and second fingerprints match in feature points to be checked and said vicinal feature points match several times for the feature points to be checked, evaluation of a matching result is enhanced depending on a number of matching

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results.

45. A computer-readable storage medium storing a program for directing a computer to realize a method  
5 for comparing an obtained first fingerprint with a preliminarily registered second fingerprint, and determining whether or not the fingerprints match each other, comprising:

10 (a) obtaining relation of a ridge containing a vicinal feature point near a feature point to be checked in a matching process performed on the first and the second fingerprints to the ridge containing a feature point to be checked in the matching process; and

15 (b) performing the matching process by searching the second fingerprint containing the vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the vicinal feature point  
20 to the ridge containing the feature point in the first feature point to be checked in the matching process.

46. A computer-readable storage medium storing a  
25 program for directing a computer to realize a method

00665159-091900

for comparing an obtained first fingerprint with a preliminarily registered second fingerprint, and determining whether or not the fingerprints match each other, comprising:

- 5 (a) generating a virtual feature point by referring to the first and the second feature points;
- (b) obtaining the relation of the ridge containing a virtual vicinal feature point near the feature point to be checked in a matching process  
10 performed on the first and the second fingerprints to the ridge containing the feature point to be checked in the matching process; and
- (c) performing the matching process by searching the second fingerprint containing the  
15 virtual vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the virtual vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching  
20 process.

47. A computer-readable storage medium storing a program for directing a computer to realize a method for comparing an obtained first fingerprint with  
25 a preliminarily registered second fingerprint, and

00665159.091900

determining whether or not the fingerprints match each other, comprising:

(a) generating a virtual feature point by referring to the first and the second feature points;

5 (b) obtaining relations of a ridge containing a vicinal feature point near the feature point, and a ridge containing a virtual vicinal point to be checked in a matching process performed on the first and the second fingerprints to the ridge containing  
10 the feature point to be checked in the matching process; and

(c) performing the matching process by searching the second fingerprint containing the vicinal feature point near the feature point to be checked  
15 in the matching process for the relation of the ridge containing the vicinal feature point to the ridge containing the feature point in the first feature point to be checked in the matching process, and performing the matching process by searching the  
20 second fingerprint containing the virtual vicinal feature point near the feature point to be checked in the matching process for the relation of the ridge containing the virtual vicinal feature point to the ridge containing the feature point in the first  
25 feature point to be checked in the matching process,

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thereby determining whether or not the feature point  
to be checked is matching.

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